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A transverse frameless Ship

The present invention relates to ships and more particularly but not exclusively to the hull construction of cargo ships such as tankers and the like.

When at sea, a tanker is subject to the influence
5 of various forces, such as for example longitudinal bending moment and torsion, water pressure against its bottom and side platings, and load from the weight of the cargo oil as sustained by the inner bottom plating and side walls of its cargo holds (oil tanks). In order to cope with these
10 forces, the hull of the tanker includes a multiplicity of longitudinals (such as side longitudinals, bottom longitudinals and central girders) extending in the lengthwise direction thereof and a multiplicity of transverses (such as side and bottom transverses) extending in
15 the widthwise direction thereof. In such hull construction, however, longitudinals and transverses are arranged in crossing relation, and this prevents automatization of certain works (such as, for example, welding) involved in
the process of shipbuilding. With a view to facilitating
20 the automatization of such works, therefore, the present inventors have come to the concept of a transverse frameless ship, that is, a ship of a double hull construction having only longitudinals connecting the inner and outer hull plates and no transverses except for transverse bulkheads
25 which extend the full depth of the ship and which are spaced apart longitudinally. However, the adoption of such double-hull construction for a ship involves various problems to be solved. For example, if the inner hull plating of a ship of such double hull construction is right-angles at its lower
30 corners to form holds having such quadrangular sectional

configuration as is seen with conventional ships, the trouble is that when water pressure exerted on the outer hull plating of the ship causes deformation to the inner hull plating through connecting longitudinals, stress concentration develops at the lower right - angled corners of the inner hull plating and consequently the corners are liable to cracking.

The object of the present invention is to provide a ship which takes best advantage of a double hull construction consisting of an inner hull plating and an outer hull plating connected together solely by plate-to-plate longitudinals, except for transverse bulkheads which extend the full depth of the ship and are spaced apart longitudinally and yet which eliminates problems arising from the absence of reinforcing transverses.

According to the invention there is provided a ship having a generally quadrangular sectional configuration, and which comprises at least at the side portions and bottom portion thereof a double hull construction consisting of an inner hull plating and an outer hull plating, transverse bulkheads extending the full depth of ship and spaced apart longitudinally of the ship and fixed to said inner and outer hull platings, and a plurality of plate-to-plate longitudinals fixed to the bulkheads, said inner and outer hull platings being connected together solely by the longitudinals except by the bulkheads, the inner and outer hull platings being rounded or slanted at least at the lower side corners of the ship.

According to the above said arrangement, the inner hull plating and outer hull plating are rounded or slanted at the lower corners of the ship, and this allows the inner and outer hull platings to be generally evenly deformed at and in the vicinity of the lower corners, when they are

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subjected to forces, thus preventing stress concentration on such areas. Therefore, when at sea, the ship is not liable to cracking at the lower corners of the hull platings.

5 Further, the fact that the ship is of a double hull construction in which the inner and outer hull platings are integrally connected together essentially solely by plate-to-plate longitudinals affords the following advantages:

10 (1) The absence of transverses in the double hull between transverse bulkheads means a smaller number of components; and the absence of plate-to-plate longitudinal-transverse intersections in the double hull greatly facilitates automatization of certain works (such as welding, for example) involved in the process of shipbuilding and also permits easy and complete inspection
15 of spaced defined between the inner and outer hull platings.

(2) The absence of plate-to-plate longitudinal-transverse intersections eliminates possible crack occurrences due to stress concentration at any such intersection.

20 (3) Spaces partitioned only by plate-to-plate longitudinals between the inner and outer hull platings can be utilized as ballast tanks. Furthermore, the fact that none of such ballast tanks are partitioned by transverses in the lengthwise direction of the ship except by transverse
25 bulkheads facilitates complete discharge of water ballast.

(4) In the event that any combustible liquid or gas in any of the holds of the ship should enter the spaces between the inner and outer hull platings as a result of a damage caused to the inner hull plating, such liquid or gas
30 can easily be expelled therefrom, since none of the spaced between transverse bulkheads are partitioned by transverses in the longitudinal direction, and accordingly the ship can be protected against the danger of explosion.

(5) The absence of transverses in the space between the inner and outer hull platings between transverse bulkheads facilitates stress-analysis of the hull construction and thus permits more reasonable arrangement of components for the purpose of weight reduction.

(6) The double hull construction prevents the run off of cargo oil in the event of a collision with any other ship or of stranding.

(7) The absence of any such projection as stiffeners or the like in the interior of any of the holds permits efficient and accurate painting, cleaning, and/or stripping of the hold interior. That also means reduced painting area.

These and other features and advantages of the invention will become apparent from the following description of embodiment taken in connection with the accompanying

drawings in which:

FIG. 1 is a cross-sectional view of a hull construction representing a first embodiment of the invention;

FIG. 2 is a view showing key parts of the hull construction.
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FIG. 3 is a perspective view of a hull construction representing a second embodiment of the invention;

FIG. 4 is a cross-sectional view of a hull construction representing a third embodiment of the invention;

10 FIG. 5 is a view showing key parts of the hull construction in FIG. 4;

FIG. 6 is a cross-sectional view of a hull construction representing a fourth embodiment of the invention;

15 FIG. 7 is a view showing key parts of the hull construction in FIG. 6;

FIG. 8 is a view in cross section of a hull construction representing a fifth embodiment of the invention;

FIG. 9 is a view illustrating key parts of the hull construction in FIG. 8;

20 FIG. 10 is a cross-sectional view of a hull construction representing a sixth embodiment of the invention; and

FIG. 11 is a view showing key parts of the hull construction in FIG. 10.

Referring first to FIG. 1, there is shown a bottom
25 portion of a ship having a generally quadrangular sectional

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configuration, the ship being of a double hull construction consisting of an inner hull plating 1 and an outer hull plating 2 connected together essentially solely by connecting longitudinals 3. The outer hull plating 2 has a horizontal bottom portion 2a, vertical side portions 2b, and rounded corner portions 2c connected to the bottom portion 2a and to the side portions 2b. Similarly, the inner hull plating 1 has a horizontal bottom portion 1a and vertical side portions 1b, and also rounded corner portions 1c connected to the bottom and side portions 1a, 1b. It is noted that the ship has transverse bulkheads (not shown) disposed in spaced apart relation in the lengthwise direction thereof, the inner and outer hull platings 1, 2 being connected together also by the transverse bulkheads.

According to the above arrangement, if the outer hull plating 2 is deformed under the influence of water pressure P, the inner hull plating 1 will be deformed likewise through the connecting longitudinals 3 (see also FIG. 2), but by virtue of the rounded corner portions 1c, 2c, the inner and outer hull platings 1, 2 as a whole will be almost evenly deformed ; therefore, any stress concentration will never develop in the rounded corner portions 1c, 2c or in areas adjacent thereto.

In the embodiment shown in FIG. 3, the inner hull plating 1 has a horizontal bottom portion 1a and vertical

side portions 1b, all said portions leading to slanted corner portions 1c'. Similarly, the outer hull plating 2 has a horizontal bottom portion 2a and vertical side portions 2b, all leading to slanted corner portions 2b. Shown by numeral 4 is a bulkhead.

In this embodiment, too, the slanted corner portions 1c' and 2c' permit the inner and outer hull platings 1, 2, as a whole, to be evenly deformed under the influence of water pressure, and therefore, the ship is not liable to stress concentration in the slanted corner portions 1c', 2c' or in the vicinity thereof.

In the embodiment shown in FIGS. 4 and 5, the outer hull plate 2 includes a horizontal bottom portion 2a, vertical side portions 2b which continue to the bottom portion 2a through lower rounded corner portions 2c, and a horizontal upper portion 2d (deck) which continues to the vertical side portions 2b through upper rounded corner portions 2e, there being disposed reinforcing deck longitudinals 5 inside the horizontal upper portion 2d. Whilst, the inner hull plating 1 includes a horizontal bottom portion 1a, vertical side portions 1b which continue to the bottom portion 1a through lower rounded corner portions 1c, and upper rounded corner portions 1c which continue to the vertical side portions 1b. Shown by numeral 6 is a hold in which is loaded liquid, or oil 7, for example.

The upper portion of the ship is always on the surface of the water, and therefore, this portion is never subject to external water pressure. However, if a ship is on sail with a half load of liquid in its hold, liquid is likely to slosh with the movement of the ship, such as rolling, thus vigorously striking the inner wall of the hold. If the upper corners of the hold are right-angled, therefore, sloshed liquid may be cut off from escape when it hits the right-angled corners, so that considerable impact may be caused to the corner portions. As a consequence, the hold will sustain deformation at the right-angled portions and in areas adjacent thereto. Thus, possibly there may develop stress concentration at the right-angled corners, with the result of cracking.

The hull construction shown in FIGS. 4 and 5 solves this problem. That is, if the liquid carried in half load in the hold is sloshed to strike the upper rounded corners 1e of the inner hull plating 1, the sloshed liquid is allowed to move along the upper corner portions 1e without being cut off from escape. Furthermore, any impact force caused in such case can merely evenly deform the upper corners 1e, 2e, and areas adjacent thereto, of the inner and outer hull platings 1, 2 (FIG. 5), no stress concentration being caused. The function of the lower rounded corners 1c, 2c of the inner and outer hull platings 1, 2

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is same as that in the embodiment shown in FIG. 1, no specific description being needed here.

The embodiment shown in FIGS. 6 and 7 is same as the one shown in FIGS. 4 and 6, except that the inner hull plating 1 has a horizontal upper portion 1d which continues to the upper rounded corner portions 1e and that the inner and outer hull platings 1, 2 are connected together by connecting longitudinals 3 throughout.

The embodiment shown in FIGS. 8 and 9 are identical with the one shown in FIGS. 4 and 5, except that upper slanted corner portions 1e', 2e' are substituted for the upper rounded corners 1e, 2e of the inner and outer hull platings 1, 2. There is no functional difference between the two embodiments.

The embodiment shown in FIGS. 10 and 11 is identical with the one shown in FIGS. 6 and 7, except that upper slanted corner portions 1e', 2e' are substituted for the upper rounded corner portions 1e, 2e of the inner and outer hull platings.

CLAIMS:

1. A ship having a generally quadrangular sectional configuration, and which comprises at least at the side portions and bottom portion thereof a double hull construction consisting of an inner hull plating, and an
5 outer hull plating, transverse bulkheads extending the full depth of ship and spaced apart longitudinally of the ship and fixed to said inner and outer hull platings, and a plurality of plate-to-plate longitudinals fixed to the bulkheads, said inner and outer hull platings being
10 connected together solely by the longitudinals except by the bulkheads, the inner and outer hull platings being rounded or slanted at least at the lower side corners of the ship.
2. A ship as set forth in claim 1 wherein the inner and outer hull platings are rounded at upper corners of the
15 ship.
3. A ship as set forth in claim 1 wherein the inner and outer hull platings are slanted at upper corners of the ship.
4. A ship as set forth in any one of claims 1 to 3
20 wherein the ship is of a double hull construction over the entire periphery thereof.
5. A transverse frameless ship substantially as described herein with reference to, and as illustrated in, Figures 1,2, or 3, or 4 or 5, or 6 and 7, or 8 and 9, or 10
25 and 11 of the accompanying drawings.

